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ABSTRACT

Researchers claim that the computer revolution has fizzled in many school districts; less than half of America's teachers use computers. This paper asserts that funding or its lack is not enough to make or break technology implementation. Factors like resistance to change and disagreement over evaluation methods that hinder the acceptance of pre-computer innovations like the New Math are still at work in the present. In order for schools to take full advantage of emerging technology they must be savvy in managing change, develop a shared education vision, and monitor spending carefully. (BEW)

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# Money Isn't Everything: Prospects and Problems in Achieving the Aims of the Computer Revolution

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# Money Isn't Everything: Prospects and Problems in Achieving the Aims of the Computer Revolution

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## Abstract

Technology is used by less than half of American teachers. Some say that funding increases will fix the problem. But American schools' earlier attempts at innovation show that funding, while necessary, may not be sufficient. Developing savvy in handling change, establishing a shared point of view, documenting changes in students' learning, and other factors are also required.

## Introduction

An examination of technology in schools shows some troubling signs. Critics of planning and implementation say that the computer revolution is stalled or off track (Borall, 1992). The enthusiasm and energy that characterized the first few years of the revolution have fizzled in many school districts and researchers tell us that less than half the teachers in the United States use computers (Anderson, 1993). Some say that federal infusions of money are needed to solve the problem and create a climate for the wide-spread, systematic implementation of technology.

In fact, for many of us who have observed the computer revolution and have had an opportunity to compare that revolution to earlier efforts to change American education, the current scene seems bleak. An infusion of federal monies, while necessary, does not seem sufficient to promote increased implementation. Other factors are at work and compromise our efforts to use technology in sites that are in trouble or haven't gotten started. The slow adoption of technology or the failure to implement in a systematic and comprehensive way echo problems that earlier innovations faced: New Math, the Comprehensive School Mathematics Project (CSMP), the School Mathematics Study Group (SMSG), and other attempts to innovate mathematics teaching; Elementary Science Study (ESS) and other attempts to innovate science teaching; Man, A Course of Study, as well as other efforts to innovate social studies teaching; Head Start's and Follow Through's efforts to prepare disadvantaged students for the rigor of elementary school classroom; programmed instruction (both through print media and mainframe computer-delivered instruction); and Open Education. Problems with those projects occurred in spite of huge infusions of federal monies, support from professional communities, and a national consensus that the skills addressed by the programs were important—conditions that apply to the technology revolution.

## Looking backward

Several factors affected attempts at innovation during pre-computer days. In some cases, the innovations ran counter to the beliefs-at-work of educators responsible for implementation or to the beliefs of the community-at-large; the evaluations were inappropriate or failed to satisfy criteria set forth by educators and the community; the innovations required training that school districts could not afford—even though federal monies had been provided to the districts; the training called for

instructional strategies that were unfamiliar to or antithetical to some educators' philosophies and practices; initial successes in implementation were difficult to sustain—either because of lack of continuing funds for staff development or shifts in school districts' goals or changes in governmental goals; the inherent tendency of institutions to perpetuate themselves in the "way it's supposed to be" tradition was at odds with many of the innovations' demands for a different way of organizing schools and classrooms. Let's take a look at a few of the innovations that were regarded as important and received the support of the federal government but have disappeared or exist in reduced and troubled circumstances.

The New Math ran counter to the beliefs-at-work of many teachers, parents, and administrators. New Math was trying to teach sophisticated mathematics concepts while teachers and parents wanted the traditional "1 + 1 = 2 and 2 + 2 = 4" curriculum. In addition, the training demands of New Math implementation were greater than the available resources of school systems. So teachers were handed textbooks and told, "Go to it, " without fully understanding what "it" was, how "it" should be taught, or why "it" should be taught at all.

Similar problems occur today. Although many software packages have attempted to address a host of problem-solving strategies, many teachers do not believe in problem solving and prefer to administer worksheets accompanying textbooks. Although software is available to help students work with geometric constructions, many teachers prefer the textbook approach. Although software is available for students to experiment with heat, light, and other phenomena, many teachers prefer to teach these concepts from the textbook. One reason for teachers sticking to business-as-usual is the dearth of visual models for how teaching with computers can be accomplished in classrooms. Another reason is the lack of compelling data from evaluations—both personal stories of how learning was enhanced and large-scale studies of the impact of those tools on a wide range of students. The trend is similar to the NIMBY trend we see in communities—"Not in my backyard, but okay for you, fellow teacher, if you want to risk your class and your reputation." Commitment to technology will only come when computer educators can say how they do what they do and how it succeeds.

Problems with evaluation hindered efforts to gain acceptance for New Math. Large scale evaluation projects were relatively new and the wide range of evaluation techniques available today were not yet in place in the early 1960's, and, for the most part, standardized tests were used as outcome measures. Standardized tests were not sensitive enough to detect differences attributable to the New Math's instruction. Although New Math evaluators did devise their own tests based on New Math goals, those tests were not convincing to decision-makers (school district superintendents, school board members, parents, teachers, even students) skeptical about the New Math's value. Consequently, an oft-heard refrain "Will it get my child into Harvard?" was heard throughout the land. This skepticism about using non-traditional test data persists. Little of the New Math's reform efforts persists on a widespread, systematic basis, although the roots of the National Council of Teachers of Mathematics' *Standards* can be seen in the New Math. But computer-using educators hear a similar refrain today—both from their colleagues and from the community members who believe using computers amounts to "play." Again, the lack of compelling stories about how technology is used in a meaningful way and what impact it makes diminish the possibility of a comprehensive spread of technology.

Developers of the Comprehensive School Mathematics Project (CSMP) had the advantage of seeing the problems associated with the New Math. They attempted to build a program that would show the lessons learned from the New Math's problems. As careful as the model builders and evaluators were, they couldn't overcome a critical factor—individuals charged with carrying out the innovation on a day-to-day basis may not implement the project as planned. For example, in evaluating the impact of the CSMP, Herbert (1984) showed differences in the problem-solving performance of students from one classroom to another—even though they all had the same ability levels. Differences in student performance from one classroom to another were often attributable to the ways teachers implemented the program—some teachers didn't teach it at all and others deformed the curriculum to a drill in "basics." This in spite of an enormous and well-crafted staff development program.

The phenomenon of differential implementation is not unknown in American classrooms, especially in districts where a major criterion for acceptance of an innovation is the "It had better get my child into Harvard" syndrome. No innovations are adopted wholeheartedly in those districts unless school staffs believe using the innovation will not jeopardize students' standardized test performance. Even when money is available for staff development, the intended goals may not be realized because of belief-at-work conflicts. So money for staff development will not automatically promote greater technology use. Teachers' belief systems must often be changed if technology is to win whole-hearted support.

Commitment of another sort was also a problem for CSMP. Just short of completing the full cycle of development, field-testing, evaluation, and wide-scale diffusion, the federal government decided to terminate funding at the level it had originally committed to. The result? A loss of faith on the part of many adopters. We know that the fickleness of funding in the past has caused many innovation-oriented teachers to eschew new innovations. "Once burned, twice shy," they say. And with good reason. If teachers were to jump to every innovation that came over the schoolhouse transom, they would be schizophrenic by now. But efforts at wide-scale technology use must confront teachers' past experiences with fickle funders.

Follow Through, a federally funded program designed to help post-Head Start students, recognized differences in teachers' philosophies-at-work and presented a choice of 7 models for adopting school districts. Each model was based on a different philosophy of education: two models were based on positive reinforcement (i.e., behaviorist principles), one model was based on the developmental model of Jean Piaget, one model was based on the English Infant School, and three were "drawn from Piaget, Dewey, and the English Infant School model."

Initial attempts to evaluate Follow Through were compromised by poor evaluation designs. Sites adopting different models were lumped together, even though the approaches to teaching and learning were fundamentally different and would be expected to produce different types of outcomes. As a result, skeptics said Follow Through did not deliver on its promises.

A wedge of skepticism was established. Stallings and her colleagues (1975) then designed an evaluation that took into account the planned variation in Follow Through and looked at several factors, including the fidelity with which individual classrooms implemented the specific model chosen by their school district and the intellectual achievement of students. The evaluations included measures such as the Metropolitan Achievement Test, Raven's Coloured Progressive Matrices, an Intellectual Achievement Responsibility Scale, as well as ratings of "desired child behavior" that included measurement of independence, task persistence, and question asking—factors deemed important in one or another Follow Through model.

Whether the belief that young children deserve an edge, or the flexibility of the model choices, or the weight of data were appealing factors, Follow Through persists, although Marshall (1980) found, in a study of Follow Through classrooms in an urban school district several years after adoption, that over time the physical environment remained as envisioned by the model developers, but structure-of-the-program factors and teaching-strategies-to promote-learning activities deviated from the model resulting in progressively lower scores in desired outcome measures each year. So implementation and intended outcomes are difficult to maintain and the CSMP finding of moving toward "traditional" methods also occurred with Follow Through. It is interesting to note that within the last few months members of the U.S. Congress have recommended a long look at Follow Through to remedy perceived problems with implementation—a concern generated by a series of on-going questions about Follow Through's current implementation and impact. It seems it is difficult for teachers to maintain the developers' vision. In part lack of training is the problem; in part there is a clash with philosophies-at-work. Similar difficulties face teachers deciding on whether or not to join the computer revolution. Follow Through was lucky in the sense that it was designed to redress the neglect of urban students and occurred in a political and economic climate very different from the climate that prevails today. Will the vision that fueled Follow Through be marshaled to jump start and sustain technology use across the country? Or will the prevailing political winds eviscerate the overall goals of technology adherents?

Let's look at one more innovation attempt. Title III of the Elementary and Secondary Education Act (ESEA) was designed to help school districts develop staff development programs, changes in school organization, or changes in the way subjects were taught. In reviewing the success of the projects the Rand Corporation conducted several case studies to assess how classroom organization changed. According to the Rand researchers, "Our most arresting finding was how little change in teachers, social context, or student performance could be related to the project. There were changes, but they seemed more episodic, faint, and dispersed than expected." (1975) Do we hear echoes of problems identified in recent studies of technology use? One of the problems was that schools had difficulties in creating teams, in supporting change, in changing what they had done that didn't work, in overcoming morale problems, and had no coping mechanisms for change. So innovation faltered because the schools couldn't surmount the internal problems—organizational, psychological, logistical—that affected attempts to do something new. The issues that had divided them before continued to divide them. A lack of savvy about moving forward caught them in a whirlpool of implementation failure. According to the Rand researchers:

> Only three projects changed teacher attitudes toward their work and place of work, but all projects could claim some changes in instructional techniques among some of their staff. Those changes were all in the direction of better, i.e., more behaviorally indicated, instruction . . .. In successful projects, perhaps as many as a third of staff in as many as half of the project schools had changed as much as half of their instructional practice.
>
> Only three projects—but all received federal monies to support change. Change, where it occurred was small, in spite of external funding. So we shouldn't be surprised at the difficulty in promoting technology-based change.

On a more pessimistic note, the Rand researchers said that at another site, "the next most successful project," there were changes in only ten percent of the schools. Rand researchers attributed successful changes to the leadership skills of the project directors. With different leadership, the results at the sites could have been different—i. e., if less dynamic leadership had been on site, less change might have occurred. Remember that the Rand studies looked at non-technology-driven innovations, so the complicating factor of dealing with hardware and software—with its various interfaces—wasn't even a contributing problem in those studies showing problematic change efforts. This information should be a cautionary verse for any teacher or administrator who believes that increased funding will make the needed difference and provided the necessary boost to technology infusion.

## Looking forward

Perhaps we think that we are wiser now, that we have learned from the innovations we have just discussed. But those innovators thought that they had learned from earlier attempts at innovation! And we shouldn't think that additional government funding, while necessary, may be sufficient to jump-start the revolution. The problems of spreading the use of technology cut across every income level, every state, and every type of school are manifold. Problems with demonstrating the impact of technology on students, problems in achieving consensus on how computers should be used, and problems in conducting staff development occur in technology-based settings and are unlikely to be solved by money alone. Leadership—especially from the top down—is often lacking. So it is possible that a national directive with associated funding, while necessary, may not be sufficient to meet the challenges pointed out by critics and commentators on the computer revolution.

Although we may have learned how to conduct more sophisticated evaluations and we may have developed better instruments to measure change, if the conditions supporting change are not present—and, in fact, if the conditions run contrary to the goals of change—caution, not optimism, is the watchword for the computer revolution. The presentation of a national agenda for school-based computing may reap the benefits of Follow Through. But then again, the dreams of computer visionaries may be as ephemeral as the dreams of the developers of SMSG, CSMP, ESS, and other projects.

Even more disturbing, failure to sustain the vision for computers in the schools may create an "I told you so," backlash, a backlash that says technology doesn't make a difference, a backlash that says spending money for technology is a waste and is accompanied by a re-direction of funding *away* from technology at the elementary or secondary school level. The responsibility for sustaining the technology revolution calls for many conditions. First is a commitment on the part of the federal government and other funders. Previous attempts at innovation have been compromised by short-term funding, by fickleness in funding, and by a zig-zag course of funding—this aspect is important this year, that aspect will be important next year. Other types of support—visual models of how teaching occurs in classroom settings, materials for teacher development, a variety of strategies for innovative ways of delivering staff development, administrator support, materials that make a clear-cut link between instructional uses of technology and the curriculum as it is and will be—are needed.

## Conclusion

Team work is an important component of any success story. As long as school districts expect one or two teachers to bear the brunt of the innovation, implementation, and evaluation process, we won't see the technology revolution move ahead. The entire school district—including parents and other stakeholders—must be involved. In this respect a history of success with innovation makes a difference. Schools and school districts that have been successful with other reform efforts will have an easier time pulling together for technology than school districts that are in disarray. Savvy plays a role here. If some school districts haven't been successful with innovations, maybe there's someone who has just emerged as a good leader; maybe a funding crisis has passed, or a new group of parents are willing to pitch in. Maybe the "veterans" of earlier efforts at innovation learned a few lessons that could make a difference this time around. But it's important for schools and school districts to realize that if change was chaotic in pre-technology times, it isn't going to be easy to cope with the complex demands imposed by technology planning, implementation, and evaluation.

Saving the best, and most important, for last, it is crucial that schools have an educational vision for technology. To be successful schools—and all within the school—must have a point of view about what to do with technology. Too often schools say money is the missing ingredient in the technology plan when, in fact, it's the lack of point of view—how will we use the technology and what do we expect it to do for our students?—that causes problems. No amount of money from the federal government will overcome the lack of an educational vision.

Given the funds targeted at introducing, expanding, and institutionalizing technology in schools—over $10 billion dollars in federal and private funds, some say—and the increased bureaucracy attached to the disbursement and supervision of these funds, it behooves us to take a caution from the past while planning for the future. We can't be sure that $10 billion allocated will ensure success. The report of the expert panel for the review of federal education program in science, mathematics, engineering, and technology, for example, in criticizing federal management of programs already in place said, "The Federal Government cannot continue to spend large sums of money without knowing if its programs are accomplishing their established goals—or if these goals address national needs in SMET education." (1993) The money must be targeted at problems identified while supplying solutions based on what we can learn from the cautions of the past. We must monitor what we do as we do it to ensure we are spending wisely and well this time around. Above all, we must pay attention to the complex impact the culture of the schools will exert to resist change.

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